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13. ABSTRACT (Maximum 200 words) Effort for the first year has concentrated on: (i) preparing a gravity wave climatology; (ii) documenting a long-lived large-amplitude wake low trough event on 16-17 November 1987, and (iii) analyzing the large-amplitude gravity wave present in the notable Midwest cyclone of 15 December 1987. The gravity wave climatology is based on hourly surface observations spanning a 10 - 15 year period at ~ 100 stations distributed fairly evenly across the United States. Preliminary results (7 stations) suggest that large-amplitude gravity wave events occur at a frequency of one or two times per year at a given station. It is hypothesized that the more complete wave-event climatology to be derived in the second year will show regional variations understandable in terms of characteristic synoptic-scale signatures conducive to wave genesis. In the 16-17 November 1987 wake low event, the wake trough remains confined to the back edge of the precipitation shield associated with a major mesoscale convective system over the lower Mississippi Valley. The approach of the wake trough is marked by the cessation of precipitation and the onset of gusty easterly winds, consistent with simple gravity wave theory. Finally, in the 15 December 1987 Midwest gravity wave event, present research is focused on the initiation of the wave event; preliminary results suggest that frontogenetical forcing may be contributing to wave generation.			
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Annual Technical Report
15 October 1992 - 14 October 1993

Air Force Office of Scientific Research Grant # F496209310002

Observational Case Studies and Diagnostic Analyses
of Long-Lived Large-Amplitude Inertia-Gravity Waves

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18 October 1993

1. Summary of Research Progress

This progress report covers research initiated during the first year ending 14 October 1993.

Effort to date has concentrated on the preparation of a gravity wave climatology, the analysis of the long-lived large-amplitude wake low trough event of 16-17 November 1987, and the analysis of the large-amplitude gravity wave present in the notable Midwest cyclone of 15 December 1987.

The gravity wave climatology is being prepared from an NCAR database of hourly surface observations that spans a 10 - 15 year period. This database consists of approximately 100 stations distributed fairly evenly across the United States. An undergraduate student, Todd Hutchinson, developed preliminary analysis programs to process a limited sample of the hourly observations during the summer of 1993. Todd's limited study (seven stations) suggests the possibility that large-amplitude gravity wave events have a frequency of occurrence of one or two times per year at a given station. We hypothesize that the more complete wave-event climatology to be derived in the coming year will show regional variations which perhaps can be understood in terms of characteristic synoptic-scale signatures conducive to wave generation. A new graduate student, Deborah Hanley, will expand and complete the climatology over the next year (with the assistance of Anton Seimon) as part of her Ph.D. thesis research, which will also include some case study analysis (STORM-FEST) and/or idealized numerical modeling of gravity-wave initiation mechanisms.

Work is proceeding on schedule with our analysis of the 16-17 November 1987 wake low event cited above. This research is in conjunction with W. Edward Bracken's Master's thesis work. Co-PI Bosart and Bracken presented results to date at the AMS 17th Severe Local Storms Conference in St. Louis, Missouri, 4-8 October 1993. The wake trough remains confined to the back edge of the precipitation shield (mostly stratiform precipitation), which is associated with a major mesoscale convective system over the lower Mississippi Valley. Our analyses reveal that the approach of the wake trough (peak pressure falls ~ 10 mb in 30 minutes or less) is marked by the cessation of precipitation and the onset of gusty easterly winds, consistent with expectations from simple gravity wave theory. We expect to complete the analysis work for this case during the next year and begin preparing our results for formal publication. Work (by Anton Seimon) is also continuing on the 15 December 1987 Midwest gravity wave event cited above. We are focusing our research effort on the initiation stage of the wave event, and we are intrigued by the possibility that frontogenetical forcing may be playing some role in wave generation.

2. Current Project Status

As of this writing we are not experiencing any unusual problems. It will take awhile for our new graduate student, Deborah Hanley, to spin up on her research, as she has the usual large first-year graduate student course load. We will also attempt to recruit an additional graduate student for September 1994 to work on other aspects of the project, such as the formulation and testing of potential vorticity inversion schemes based on the nonlinear balance equations as a means to isolate gravity waves in observed and modeled datasets. Should this recruitment effort be successful, we will likely request supplemental funding for an additional graduate student.

3. Publications

No refereed papers as yet. One recent conference presentation as follows:

"An Analysis of a Long-Lived Wake Low", poster presentation by W. Edward Bracken and Lance F. Bosart at the 17th Conference on Severe Local Storms, American Meteorological Society, 4-8 October 1993, St. Louis, Missouri.

4. Project Personnel

Co PIs:	Lance F. Bosart Daniel Keyser
Staff Support:	Anton Seimon
Graduate Student:	Deborah Hanley (beginning September 1993)
Undergraduate Student:	Todd Hutchinson (through August 1993; now a graduate student at the University of Oklahoma)
Administrative Support:	Celeste Iovinella

5. Coupling Activities

- (a) "An Analysis of a Long-Lived Wake Low", poster presentation by W. Edward Bracken and Lance F. Bosart at the 17th Conference on Severe Local Storms, American Meteorological Society, 4-8 October 1993, St. Louis Missouri.
- (b) "Scientific Opportunities from two remarkable storms: (1) Hurricane David, September 1979: A Born-Again Tropical Storm, and (2) the Blizzard of '93: An Unprecedented Subtropical Development, invited talk by Lance F. Bosart to the Geosciences Group, Los Alamos National Laboratory, 23 July 1993, Los Alamos, New Mexico.

6. Budget

As originally requested, except that we would like to explore the feasibility of requesting additional funds (~\$10,000) to purchase a UNIX Workstation for project use during the conversion of the SUNY/Albany computer system from VMS to UNIX. This workstation would facilitate Deborah Hanley's research.

7. Other Pertinent Project Information

- (a) Second year research plans remain unchanged.
- (b) No change to project personnel except the recruitment of an additional graduate student.